

not interfere with their photosynthesis. But the cuticle is strongly developed, and intercellular spaces are very inconspicuous in the leaf. As the plants grow taller the leaves are more of the time above water, and are stiff enough so that many of them stand erect above the surface, but when too great a length is exposed they float. Free movement of gases, when the leaves float or are submerged, is insured by the position of the stomata. These occur only on the upper surface of the leaves, where they are confined to the sides of deep and narrow clefts. The walls of these clefts are beset with papillæ, which further narrow them and increase their surface until it is practically impossible that the air in them should be driven out by water. The stomata being protected against plugging by water, the plants continue to take up carbon dioxide though entirely under water (*Cf.* Pfeffer, *Pflanzenphysiologie*, 1: 161, 2d ed.). As must be expected, especially from Stange's work (*Bot. Zeit.* 1892), the plant meets the concentration of the sea water with an over-regulation of its turgor. In the mesophyll, in a leaf reaching above high tide, I have found plasmolysis just beginning in 7.5 per cent. KNO₃; in the cortex of the roots, in 7 per cent. KNO₃. I could find no root hairs.

SHORTER NOTES

WEeping TOMATOES.—Some days after clearing off a plot of ground in tomatoes for the past season it was observed that the places where the plants had stood were moist while all the other area was covered with the dry, finely raked earth. Upon examination it was found that this moisture was due to water that flowed from the roots of the tomato plants that had broken off and remained in the soil in the process of pulling. Further inspection showed that when a broken end of one of the larger roots chanced to extend above the soil its exposed fraction was wet and dripped water so that it glistened in the late October sun. From some roots that arched over with the broken end pointed downward the water fell in drops to the soil which was literally muddy below the live spigot.

Having other plots to clear, many of the tomato plants were

cut at the surface of the soil, and the root system in each left undisturbed in the soil. The location of all such roots could be easily seen by the wet place around them for a week after the removal of the vines. In some instances the otherwise dry soil was moist for a foot or more from the stump and decidedly muddy near the center of the wet circle.

Up to the time when the vines were removed there had been no hard frosts and the plants, still in flower, were loaded with fruit and therefore the breaking of the roots was at a time when they were active in taking up water. However, the flow was so copious that the fact is mentioned with the thought that some vegetable physiologist may find in the tomato a fruitful subject for the study of the obscure phenomenon of "bleeding" in plants.—BRYON D. HALSTED.

THE GENERATIVE DIVISIONS IN GYMNASPERMS.*—In February, 1900, while examining a number of my slides made from the ovules of *Pinus rigida*, it was my good fortune to discover that interesting division in the pollen tube which botanists had been so eagerly seeking in conifers since the discovery of blepharoplasts in *Gingko*, *Cycas* and *Zamia*. Careful examination of several slides, however, failed to bring to light the "reduced blepharoplasts" which had been predicted and further search for them was abandoned; but I was impressed with the peculiar fibrous appearance of the cytoplasm and the position of the spindle in the antheridial cell. These impressions gained considerably in force when, a few weeks later, I discovered and worked out in detail the method of division in the formation of the ventral canal-cell in *Tsuga Canadensis*; † for I found these two so-called generative divisions to be at once unique and strikingly similar.

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In brief, the two divisions occur approximately at the same time, are both unequal, and the spindles are the same in origin, development and type. In both cases the force initiating division originates below the nucleus in cytoplasm afterwards belong-

* An abstract from an address on Fertilization in Gymnosperms delivered at the Fifth International Zoölogical Congress, Berlin, August 15, 1901.

† The Development of the Archegonium and Fertilization in the Hemlock Spruce. *Annals of Botany*, 14: 583-607. D. 1900.

ing to the persisting functional cell; in both cases two cells are formed, one capable of taking active part in fertilization, while the other is ultimately a total loss involving only a small part of the cytoplasm of the parent cell but half of its chromatic contents. In the hundreds of cases of fertilization among gymnosperms which I have studied, the mature functional sexual cells have invariably developed from the lower larger daughter cells produced by the unequal generative divisions.—W. A. MURRILL.

CUPANIA ON PINE KEY, FLORIDA.—A specimen, labelled *Paullinia*, showing foliage and flower-buds of a tree collected many years ago by Mr. Blodgett on Pine Key, Florida, has hitherto remained undetermined in the Columbia University herbarium, Dr. Small's studies not having as yet reached Sapindaceae, and Dr. Robinson, noticing the specimen while preparing the manuscript of this family for "Synoptical Flora" disposed of it with the annotation "some other genus?"—a pertinent suggestion. I think there can be no doubt that it represents a species of *Cupania*, probably *C. glabra* Sw., which is thus to be added to the arboreous flora of the United States. Mr. Blodgett's label records that it grew on hammocks and flowered in September.—N. L. BRITTON.

FIELD DAYS OF THE TORREY BOTANICAL CLUB.—On the excursion of August 24th, along the Palisades, New Jersey, the Misses Clarke and Esterly represented the New York Botanical Garden. The following are some of the interesting plants found: *Gyrostachys gracilis* (Bigel.) Kuntze; *Silene stellata* (L.) Ait.; *Actaea alba* (L.) Mill. in fruit; *Aralia racemosa* L.; *Clethra alnifolia* L.; *Eupatorium purpurcum falcatum* (Mx.) Britton; *Aster Schreberi* Nees; *Helianthus divaricatus* L., and *H. decapetalus* L.

The Club went to Mt. Vernon, August 31st, Dr. P. A. Rydberg acting as the Garden's representative. The following plants were found: *Lobelia syphilitica* L.; *Rhexia Virginica* L.; *Decodon verticillatus* (L.) Ell.; *Dioscorea villosa* L. in fruit; *Prunus serotina* Ehrh. in fruit; *Meibomia Canadensis* (L.) Kuntze; and a decumbent fruiting plant of *Rubus nigrobaccus* Bailey. Dr. Rydberg also found an interesting form of *Impatiens biflora* Walt., with pink, spotted flowers, growing with the common form which has orange-yellow, mottled flowers.